2. Progress Towards Automated Data Entry and an Internet Based Pest Alert System

Prepared by Vasile Catana

Data Sources and Methodology

The team involved in the AWPM project is collecting data on 23 fields located in different states as outlined in earlier sections of this document. The size of each field is around 120 acres and they are distributed throughout the Great Plains. On each field a grid of 25 uniformly distributed sampling points is established and each time they use the GPS tool to identify the points and a Pocket PC to register the data in Excel format. Everywhere they use identical entomological methods in the field and in the laboratory, so data are comparable. The sampling includes at least four vegetation periods on seven different crops characteristic for each zone: wheat, sunflower, soybean, sorghum, cotton, alfalfa, and millet.

In addition to the aphid information described in the introduction, the entomologists collect and register data on about 18 important predator species, five parasitoid species, and 15 weed species. These 15 weed species can be considered as a refuge places and reserves for aphid populations in specific vegetation phases. All the information from the Pocket PC is downloaded in Excel format files on a Windows PC in laboratory. At the USDA-Ars PSRL, Stillwater, OK we organized a server with Microsoft Windows 2000 Advanced Server© that contains MS IIS (Microsoft Internet Information Service). In the future we will replace it with Windows 2003 Server that has a more efficient IIS service than version 6.0. On this server we installed Oracle 9i AS RDBMS© and we organized an AWIPM database with tables corresponding to the structure of our collected information. With Visual Studio 6.0 we developed an independent Visual Basic application that can be deployed on any PC that runs the Windows operating system once Oracle Net Manager© is installed on it. Oracle Net Manager contains all required objects used in the Visual Basic application to make a link between the client computer and the server database computer. The Visual Basic application has the following four functionalities:

1. A user login to a database using a user name and password with the possibility to change the password.
2. Data view of all information beforehand introduced by other users from other places.
3. The capability for each user to modify/correct only his/her data.
4. Data input into corresponding database tables from existing Excel tables.

The last functionality is complex, because it contains the structure detection and data validation of all information in each type (format) of the Excel tables. If the Excel table contents an error or other format inconsistency, the user will be prompted with a message about the type of the error and its place (coordinates) in the table. At the present time we have developed this part of the application for only eight Excel format tables and we have to do it for another six. The structure of each future table has to be coordinated with all participants from the project and it has to take into account the work volume we have to do subsequently to the database.

The VB application will be sent to all participants involved in the AWIPM project in the near future. Each computer that will run the VB application has to be configured only once by installing the Oracle Net Manager on it. The Oracle Net Manager is free software and can be downloaded from the Internet (from the Oracle Corporation site). At the installation the user has only to indicate the parameters and the IP address of the database server. When the VB

application is running it makes a link with our database on the server via the Oracle Net Manager.
From the inside of the IIS we can make a link between AWIPM database and a web site located on the same or on a different server. In the future we will develop more complex web pages using ASP (Active Server Pages) and giving the possibility to all growers to know what currently happen with the aphid populations in their region. We will tray to do some link between our AWIPM database and the SAS software for result interpretation.

Anticipated Uses for the System

All sampling points in our researches have their geographic coordinates, so we can represent the information about the densities of aphid species and their enemies using the GIS software at both small (field) and large spatial scales (Great Plains). Because GIS is a tool that allows assembly of geographically referenced and nongeographic data on different ecological properties, we can integrate them with other software and modeling methods to generate new information. We can also derive new data that are syntheses of these data, and analyze the new data to map spatial variables such as habitat, species distribution, and movements of individuals. 1998).

First of all using our AWIPM database we will be capable of constructing maps of the Great Plains with the complete view of the current aphid situation corresponding to the most recent introduced data from all places involved in project. This kind of presentation can be very useful for the grower community because it will be operative, current, and precise. It is known that periods with relatively low aphid densities alternate irregularly with periods where outbreaks of aphid populations occur. If such an outbreak occurs in a location growers will pay more attention to the pest situation in their fields during this critical period. Later we will concentrate our attention on these outbreak periods to figure out what are the preliminary conditions that provoke them, like temperature, precipitation, beneficial entomofauna, etc.

As our database increases in size it will become more useful in our future studies to determine the causes and conditions under which aphid outbreaks occur. We need more statistics about the spatial and temporal distribution of all studied insect populations. The modifications of the models (1) – (3) can help us to elucidate the character of the interaction between aphid populations and their parasitoids and predators. They can serve as a starting point in our simulation models and other applications such as artificial intelligence tools.

The models (1) – (3) are useful for spatial and temporal population descriptions at the qualitative level. In order to simplify them and to determine analytical solutions (trajectories and surfaces) it assumed that their parameters are constant. In reality all the parameters are functions of the environmental factors; they reflect the specie physiology and reaction to particular (concrete) conditions. The best example in this sense for aphids is the intrinsic rate of population increase that changes with temperature.

Particularly the sampling of specific fields at certain dates can be considered as particular solutions for some generalized model (3). Using kriging or interpolation methods we can construct exact surfaces that represent solutions (realizations) of such a generalized model. Under these conditions we can try to solve the inverse task, to give a concrete parameterization to the model (3) knowing its quotient solutions. In the future

we can test these new identified spatial-temporal models (3) using newly collected data. Because all data have their locations using GPS it will be a relatively easy task.